

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§	
David M. Mills et al.	§	Group Art Unit: 3768
	§	
Serial No.: 10/676,202	§	Confirmation No.: 7118
	§	
Filed: October 1, 2003	§	Examiner: Casler, Brian L.
	§	
For: FOCUSING MICROMACHINED	§	Atty. Docket: 132147-2/SWA/
ULTRASONIC TRANSDUCER	§	GERD:0566
ARRAYS AND RELATED	§	
METHODS OF MANUFACTURE	§	

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September 11, 2008	/Tait R. Swanson/
Date	Tait R. Swanson
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APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

Appellants hereby file this Appeal Brief in furtherance to the Notice of Appeal and the Pre-Appeal Brief Request for Review electronically filed on February 11, 2008. Despite repeated teleconferences with Examiner Brian L. Casler over many months, Appellants have still not received a Notice of Panel Decision. Accordingly, Appellants hereby file this Appeal Brief in an attempt to expedite the present appeal.

The Commissioner is authorized to charge the requisite fee of \$510.00 for this Appeal Brief, and any additional fees which may be necessary to advance prosecution of the present application, to Deposit Account No. 07-0868; Order No. 132147-2/SWA (GERD:0566). Given that Appellants have not received a Notice of Panel Decision, no fees are currently due for an extension of time.

1. **REAL PARTY IN INTEREST**

The real party in interest is General Electric Company, the Assignee of the above-referenced application. Accordingly, General Electric Company will be directly affected by the Board's decision in the pending appeal.

2. **RELATED APPEALS AND INTERFERENCES**

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. **STATUS OF CLAIMS**

Claims 1-4, 6-9, 11-18, 39-42 and 44-46 are finally rejected and currently pending. Claims 5, 10, 19-38, and 43 are cancelled. Thus, claims 1-4, 6-9, 11-18, 39-42 and 44-46 are the subject of this Appeal.

4. **STATUS OF AMENDMENTS**

Appellants have not submitted any amendments subsequent to the Final Office Action mailed on August 23, 2007. Consequently, there are no outstanding amendments to be considered by the Board.

5. **SUMMARY OF CLAIMED SUBJECT MATTER**

Embodiments of the present invention relate generally to arrays of micromachined ultrasonic transducers (MUTs). The Application contains three independent claims, namely, claims 1, 39, and 45 all of which are the subject of this Appeal. The subject matter of these claims is summarized below.

With regard to the aspect of the invention set forth in independent claim 1, discussions of the recited features of claim 1 can be found at least in the below cited locations of the specification and drawings. By way of example, independent claim 1 recites an ultrasonic probe that comprises an array of MUT cells (*e.g.*, 2, 18, 46). *See*,

e.g., Published Application, FIGS. 1-3; paragraphs [0030], [0036], [0037], [0072], and [0073]. The ultrasonic probe also comprises a curved lens (*e.g.*, 28, 30, 32, 50) coupled to the array of MUT cells (*e.g.*, 2, 18, 46). *See, e.g.*, Published Application, FIGS. 4-6 and 8; paragraphs [0041] – [0044], [0071], and [0072].

With regard to the aspect of the invention set forth in independent claim 39, discussions of the recited features of claim 39 can be found at least in the below cited locations of the specification and drawings. By way of example, independent claim 39 recites an integrated device comprising a curved lens (*e.g.*, 28, 30, 32, 50). *See, e.g.*, Published Application, FIGS. 4-6 and 8; paragraphs [0041] – [0044], [0071], and [0072]. The integrated device also comprises a first multiplicity of MUT cells (*e.g.*, 2, 18, 46) hard-wired together and disposed underneath the curved lens (*e.g.*, 28, 30, 32, 50). *See, e.g.*, Published Application, FIG. 3; paragraphs [0038] – [0041]. The integrated device also comprises a second multiplicity of MUT cells (*e.g.*, 2, 18, 46) hard-wired together and disposed underneath the curved lens (*e.g.*, 28, 30, 32, 50). *See id.* For example, FIG. 3 illustrates sub-regions 22, 24, and 26 of cMUT cells. *See id.* The integrated device also comprises CMOS electronics (*e.g.*, 18, 44) disposed underneath the first and second multiplicities of MUT cells (*e.g.*, 2, 18, 46). *See, e.g.*, Published Application, FIG. 7; paragraphs [0040], [0041], [0047], and [0048]. The integrated device also comprises a silicon substrate (*e.g.*, 40) disposed underneath the CMOS electronics (*e.g.*, 18, 44). *See, e.g.*, Published Application, FIGS. 7-8; paragraphs [0047] and [0072].

With regard to the aspect of the invention set forth in independent claim 45, discussions of the recited features of claim 45 can be found at least in the below cited locations of the specification and drawings. By way of example, independent claim 45 recites an ultrasonic probe comprising a plurality of micromachined ultrasonic transducer cells (*e.g.*, 2, 18, 46). *See, e.g.*, Published Application, FIGS. 1-3; paragraphs [0030], [0036], [0037], [0072], and [0073]. The ultrasonic probe also comprises a curved lens (*e.g.*, 28, 30, 32, 50) coupled in at least close proximity or directly to membranes of the

plurality of micromachined ultrasonic transducer cells (*e.g.*, 2, 18, 46). *See, e.g.*, Published Application, FIGS. 4-6 and 8; paragraphs [0041] – [0044], [0071], and [0072].

6. **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

First Ground of Rejection:

The Examiner rejected claims 1, 2, 8, 16, 42, and 45 under 35 U.S.C. § 102(e) as being anticipated by Rafter et al. (U.S. Pat. No. 6,425,869; hereinafter “Rafter”).

Second Ground of Rejection:

The Examiner rejected claim claims 1, 2, 8, 16, 42, and 45 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel et al. (U.S. Pat. No. 6,605,043; hereinafter “Dreschel”).

Third Ground of Rejection:

The Examiner rejected claims 3, 4, 9, and 46 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel, further in view of Ishrak et al. (U.S. Pat. No. 5,667,491; hereinafter “Ishrak”).

Fourth Ground of Rejection:

The Examiner rejected claims 6 and 7 under 35 U.S.C. § 103(a) as unpatentable over Rafter alone, or in view of Dreschel, and further in view of Fraser (U.S. Pat. No. 6,328,696; hereinafter “Fraser”).

Fifth Ground of Rejection:

The Examiner rejected 11 and 12 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel, and further in view of Hanafy (U.S. Pat. No. 6,258,034; hereinafter “Hanafy”).

Sixth Ground of Rejection:

The Examiner rejected claims 13 and 14 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel, further in view of Ishrak, and further in view of Eaton et al. (U.S. Pat. No. 5,876,345; hereinafter “Eaton”).

Seventh Ground of Rejection:

The Examiner rejected claim 15 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel, further in view of Ishrak, and further in view of Snow (U.S. Pat. No. 6,749,554; hereinafter “Snow”).

Eighth Ground of Rejection:

The Examiner rejected claim 17 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel, and further in view of Robinson (U.S. Pat. No. 6,659,954; hereinafter “Robinson”).

Ninth Ground of Rejection:

The Examiner rejected claim 18 under 35 U.S.C. § 103(a) as unpatentable over Friemel et al. (U.S. Pat. No. 6,537,220; hereinafter “Friemel”) in view of Barnes et al. (U.S. Pat. No. 6,676,602; hereinafter “Barnes”).

Tenth Ground of Rejection:

The Examiner rejected claims 39, 40, and 44 under 35 U.S.C. § 103(a) as unpatentable over Rafter alone, or in view of Dreschel, in either case further in view of Fraser and Chiao et al. (U.S. Pat. No. 5,882,309; hereinafter “Chiao”) or Mason et al. (U.S. Pat. No. 5,931,785; hereinafter “Mason”). The Examiner also mentioned Barnes and Friemel in the body of this rejection.

Eleventh Ground of Rejection:

The Examiner rejected claim 41 under 35 U.S.C. § 103(a) as unpatentable over Rafter alone, or in view of Dreschel, in either case further in view of Fraser and Chiao or Mason, and further in view of Robinson.

7. ARGUMENT

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under Sections 102 and 103. Accordingly, Appellants respectfully request full and favorable consideration by the Board, and reversal of the outstanding rejections. Appellants strongly believe that independent claims 1, 39, and 45 and their dependent claims are currently in condition for allowance.

Appellants respectfully assert that the pending claims are patentable over the cited reference in view of the following remarks. Appellants stress that the Section 102 rejection relies on Rafter and each of the Section 103 rejections relies on Rafter in view of Dreschel (and often additional references) except for the Ninth and Tenth Grounds of Rejection, which rely on Friemel and Barnes for claims 18, 39, 40, and 44. Rafter is deficient for the reasons discussed in detail below, and none of the secondary references obviate these deficiencies of Rafter. Moreover, Appellants previously submitted a Rule 131 declaration to swear behind both Friemel and Barnes. Thus, the rejections based on Friemel and Barnes are improper and must be withdrawn.

A. **First Ground of Rejection**

The Examiner rejected claims 1, 2, 8, 16, 42, and 45 under 35 U.S.C. § 102(e) as anticipated by Rafter. Of these, claims 1 and 45 are independent.

Legal Precedent

First, the pending claims must be given an interpretation that is reasonable and consistent with the *specification*. See *In re Prater*, 415 F.2d 1393, 1404-05, 162 U.S.P.Q. 541, 550-51 (C.C.P.A. 1969) (emphasis added); see also *In re Morris*, 127 F.3d 1048, 1054-55, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997); see also M.P.E.P. §§ 608.01(o) and 2111. Indeed, the specification is “the primary basis for construing the claims.” See *Phillips v. AWH Corp.*, No. 03-1269, -1286, at 13-16 (Fed. Cir. July 12, 2005) (*en banc*). One should rely *heavily* on the written description for guidance as to the meaning of the claims. See *id.*

Second, interpretation of the claims must also be consistent with the interpretation that *one of ordinary skill in the art* would reach. See *In re Cortright*, 165 F.3d 1353, 1359, 49 U.S.P.Q.2d 1464, 1468 (Fed. Cir. 1999); M.P.E.P. § 2111. “The inquiry into how a person of ordinary skill in the art understands a claim term provides an objective baseline from which to begin claim interpretation.” See *Collegenet, Inc. v. ApplyYourself, Inc.*, No. 04-1202, -1222, 1251, at 8-9 (Fed. Cir. August 2, 2005) (quoting *Phillips*, No. 03-1269, -1286, at 16). The Federal Circuit has made clear that derivation of a claim term must be based on “usage in the ordinary and accustomed meaning of the words amongst artisans of ordinary skill in the relevant art.” See *id.*

Third, anticipation under section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985). For a prior art reference to anticipate under section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper

rejection under section 102, a single reference must teach each and every limitation of the rejected claim. *Atlas Powder v. E.I. du Pont*, 750 F.2d 1569 (Fed. Cir. 1984). Accordingly, Appellants need only point to a single element not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter. The prior art reference also must show the *identical* invention “*in as complete detail as contained in the ... claim*” to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989).

Fourth, if the Examiner relies on a theory of inherency, the extrinsic evidence must make clear that the missing descriptive matter is *necessarily* present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. *In re Robertson*, 169 F.3d 743, 49 U.S.P.Q.2d 1949 (Fed. Cir. 1999) (Emphasis Added). The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient. *Id.* In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the applied prior art. *Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). The Examiner, in presenting the inherency argument, bears the evidentiary burden and must adequately satisfy this burden. *See id.* Regarding functional limitations, the Examiner must evaluate and consider the functional limitation, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used. *See* M.P.E.P. § 2173.05(g); *In re Swinehart*, 169 U.S.P.Q. 226, 229 (C.C.P.A. 1971); *In re Schreiber*, 44 U.S.P.Q.2d 1429, 1432 (Fed. Cir. 1997). If the Examiner believes the functional limitation to be inherent in the cited reference, then the Examiner “must provide some evidence or scientific reasoning to establish the reasonableness of the examiner’s belief that the functional limitation is an inherent characteristic of the prior art.” *Ex parte Skinner*, 2 U.S.P.Q.2d 1788, 1789 (Bd. Pat. App. & Inter. 1986).

Fifth, the *drawings* of the cited reference must be evaluated for what they *reasonably disclose and suggest* to one of ordinary skill in the art. *In re Aslanian*, 590 F.2d 911, 200 U.S.P.Q. 500 (CCPA 1979). Arguments based on dimensions of the drawing features are of little value where the reference does not disclose specific dimensions or any indication of whether the drawings are to scale. *See Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956, 55 U.S.P.Q.2d 1487, 1491 (Fed. Cir. 2000).

Features of independent claim 1 omitted from Rafter

Turning to the claims, independent claim 1 recites “[a]n ultrasonic probe comprising an array of MUT cells and a curved lens coupled to the array of MUT cells.”

The Rafter reference fails to teach or suggest “a curved lens coupled to the array of MUT cells,” as recited by independent claim 1. The Examiner stated that “[the Rafter reference] teaches a cMUT embodiment associated with Fig. 6 and col. 13-14 top lines where the curved partially cylindrical lens 210 depicted in Fig. 2 in association with the single piezocrystal multi-element diced design may be assumed to be also used with the MUT variant which is stated to be interchangeable therewith.” Office Action, page 3. However, the Rafter reference merely states that “the response characteristics associated heretofore with a multi-element single crystal transducer may be accomplished with a MUT” and that FIG. 6 illustrates a MUT in accordance with the invention. Rafter, col. 13, lines 28-32. The Rafter reference never teaches or suggests that the MUT described in columns 13-14 may be coupled to a curved lens in the same way as the single crystal element slivers illustrated in FIG. 2 of the Rafter reference. Indeed, the MUT embodiment is an entirely separate embodiment of the Rafter reference. Suggesting that multi-element single crystal transducers may have similar response characteristics to MUTs does not necessarily suggest that similar coupling to a curved lens is possible. Furthermore, the Brief Description of the Drawings section notes that FIG. 6 “is a

simplified cross-sectional view illustrating a micro-machined ultrasonic transducer (MUT) that can be integrated with the ultrasonic imaging system of FIG. 1.” (Emphasis added). It does not suggest that FIG. 6 can be integrated into FIG. 2, which shows the coupling with a curved lens. For comparison, the Brief Description of the Drawings section notes that FIG. 2 “is a perspective drawing of an ultrasonic transducer having single crystal element slivers and multiple matching layers that can be integrated with the ultrasonic imaging system of FIG. 1.” (Emphasis added). Therefore, FIGS. 2 and 6 are alternative embodiments that both represent transducers 102 as depicted in FIG. 1 of the Rafter reference. Hence, the Rafter reference does not teach or suggest “an array of MUT cells and a curved lens coupled to the array of MUT cells” since the curved lens is a part of the embodiment illustrated in FIG. 2 and the MUT cells are a part of an alternative embodiment illustrated in FIG. 6.

For at least these reasons, among others, Appellants stress that the Rafter reference cannot support a *prima facie* case of anticipation of independent claim 1 and its dependent claims.

Features of independent claim 45 omitted from Rafter

Independent claim 45 recites, *inter alia*, “a curved lens coupled in at least close proximity or directly to membranes of the plurality of micromachined ultrasonic transducer cells.”

The Rafter reference fails to teach or suggest “a curved lens coupled in at least close proximity or directly to membranes of the plurality of micromachined ultrasonic transducer cells.” In contrast, the Rafter reference discloses single crystal element slivers 214 and an acoustic lens 210 with multiple matching layers 212 interposed between them. *See, e.g.*, Rafter, col. 10, lines 29-39; FIG. 2. As discussed above with respect to independent claim 1, FIG. 2 of the Rafter reference illustrates an entirely separate embodiment from the MUT embodiment illustrated in FIG. 6. There is absolutely no

teaching or suggestion that these separate embodiments can be combined with one another. In fact, the Rafter reference fails to even mention how a curved lens could be coupled to the embodiment of FIG. 6. Furthermore, it is clear that the matching layers 212 interposed between the single crystal element slivers 214 and the acoustic lens 210 preclude the acoustic lens 210 from being “coupled in at least close proximity or directly to membranes” of the single crystal element slivers 214, much less a plurality of micromachined ultrasonic transducer cells.

For at least these reasons, among others, Appellants stress that the Rafter reference cannot support a *prima facie* case of anticipation of independent claim 45 and its dependent claims. Accordingly, Appellants respectfully request withdrawal of the rejections under 35 U.S.C. § 102.

B. Second Ground of Rejection

The Examiner rejected claims 1, 2, 8, 16, 42, and 45 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel. Of these, claims 1 and 45 are independent.

Legal Precedent

The pending claims must be given an interpretation that is reasonable and consistent with the *specification*. See *In re Prater*, 415 F.2d 1393, 1404-05, 162 U.S.P.Q. 541, 550-51 (C.C.P.A. 1969) (emphasis added); see also *In re Morris*, 127 F.3d 1048, 1054-55, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997); see also M.P.E.P. §§ 608.01(o) and 2111. Indeed, the specification is “the primary basis for construing the claims.” See *Phillips v. AWH Corp.*, No. 03-1269, -1286, at 13-16 (Fed. Cir. July 12, 2005) (*en banc*). One should rely *heavily* on the written description for guidance as to the meaning of the claims. See *id.*

Interpretation of the claims must also be consistent with the interpretation that *one of ordinary skill in the art* would reach. See *In re Cortright*, 165 F.3d 1353, 1359, 49

U.S.P.Q.2d 1464, 1468 (Fed. Cir. 1999); M.P.E.P. § 2111. “The inquiry into how a person of ordinary skill in the art understands a claim term provides an objective baseline from which to begin claim interpretation.” See *Collegenet, Inc. v. ApplyYourself, Inc.*, 418 F.3d 1225, 75 U.S.P.Q.2d 1733, 1738 (Fed. Cir. 2005) (quoting *Phillips v. AWH Corp.*, 75 U.S.P.Q.2d 1321, 1326). The Federal Circuit has made clear that derivation of a claim term must be based on “usage in the ordinary and accustomed meaning of the words amongst artisans of ordinary skill in the relevant art.” See *id.*

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). In addressing obviousness determinations under 35 U.S.C. § 103, the Supreme Court in *KSR International Co. v. Teleflex Inc.*, No. 04-1350 (April 30, 2007), reaffirmed many of its precedents relating to obviousness including its holding in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). In *Graham*, the Court set out an objective analysis for applying the statutory language of §103:

Under §103, the scope and content of the prior art are to be determined, differences between the prior art and the claims at issue are to be ascertained, and the level of ordinary skill in the pertinent art are to be resolved. Against this background the obviousness or non-obviousness of the subject matter is to be determined. Such secondary considerations as commercial success, long-felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. *KSR, slip op.* at 2 (citing *Graham*, 383 U.S. at 17-18).

In *KSR*, the Court also reaffirmed that “a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *Id.* at 14. In this regard, the *KSR* court stated that “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does ... because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in

some sense, is already known.” *Id.* at 14-15. Traditionally, to establish a *prima facie* case of obviousness, the CCPA and the Federal Circuit have required that the prior art not only include all of the claimed elements, but also some teaching, suggestion, or motivation to combine the known elements in the same manner set forth in the claim at issue. *See, e.g., ASC Hospital Systems Inc. v. Montifiore Hospital*, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984) (holding that obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination.); *In re Mills*, 16 U.S.P.Q.2d 1430, 1433 (Fed. Cir. 1990) (holding that the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination). In *KSR*, the court noted that the demonstration of a teaching, suggestion, or motivation to combine provides a “helpful insight” in determining whether claimed subject matter is obvious. *KSR, slip op.* at 14. However, the court rejected a *rigid* application of the “TSM” test. *Id.* at 11. In this regard, the court stated:

The obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and explicit content of issued patents. The diversity of inventive pursuit and of modern technology counsels against limiting the analysis in this way. In many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature, will drive design trends. *Id.* at 15.

In other words, the *KSR* court rejected a rigid application of the TSM test which requires that a teaching, suggestion or motivation to combine elements in a particular manner must be explicitly found in the cited prior art. Instead, the *KSR* court favored a more expansive view of the sources of evidence that may be considered in determining an apparent reason to combine known elements by stating:

Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art all in order to determine whether

there was an apparent reason to combine in the known elements in the fashion claimed in the patent at issue. *Id.* at 14.

The *KSR* court also noted that there is not necessarily an inconsistency between the idea underlying the TSM test and the *Graham* analysis, and it further stated that the broader application of the TSM test found in certain Federal Circuit decisions appears to be consistent with *Graham*. *Id.* at 17-18 (citing *DyStar Textilfarben GmbH and Co. v. C.H. Patrick Co.*, 464 F.3d 1356, 1367 (2006) (“Our suggestion test is in actuality quite flexible and not only permits but *requires* consideration of common knowledge and common sense”); *Alza Corp. v. Mylan Labs, Inc.*, 464 F.3d 1286, 1291 (2006) (“There is flexibility in our obviousness jurisprudence because a motivation may be found *implicitly* in the prior art. We do not have a rigid test that requires a teaching to combine ... “)).

Furthermore, the *KSR* court did not diminish the requirement for objective evidence of obviousness. *Id.* at 14 (“To facilitate review, this analysis should be made explicit. See *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”); see also, *In re Lee*, 61 U.S.P.Q.2d 1430, 1436 (Fed. Cir. 2002) (holding that the factual inquiry whether to combine references must be thorough and searching, and that it must be based on *objective evidence of record*).

When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One

cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, “fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.” *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)).

It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983); M.P.E.P. § 2145. Moreover, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959); *see* M.P.E.P. § 2143.01(VI). If the proposed modification or combination would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984); *see* M.P.E.P. § 2143.01(V).

In addition, “it is well established that product claims may include process steps to wholly or partially define the claimed product.” *In re Luck*, 177 U.S.P.Q. 523, 525 (C.C.P.A. 1973). To the extent that “these process limitations distinguish the *product* over the prior art, they must be given the same consideration as traditional product characteristics.” *Id.* (emphasis in original). These claims are not product-by-process claims. A product-by-process claim defines a product by laying out the method steps required to produce the product. *See Atlantic Thermoplastics Co. Inc. v. Faytex Corp.*, 23 U.S.P.Q.2d 1481, 1490 (Fed. Cir. 1992). This is far different from a mixed limitation or hybrid claim that includes a functional limitation, but does not define the product solely

by method steps. The general rule for interpreting hybrid claims is that all limitations are to be given patentable effect. See *In re Angstadt*, 190 U.S.P.Q. 214, 217 (C.C.P.A. 1976).

In order to rely on equivalence as a rational supporting an obviousness rejection, the equivalency must be recognized in the prior art, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents. *In re Ruff*, 256 F.2d 590, 118 U.S.P.Q. 340 (CCPA 1958); see also M.P.E.P. § 2144.06.

Features of independent claim 1 omitted from the cited references

Independent claim 1 recites “[a]n ultrasonic probe comprising an array of MUT cells and a curved lens coupled to the array of MUT cells.”

The cited references, taken alone or in hypothetical combination, fail to teach or suggest “a curved lens coupled to the array of MUT cells,” as recited by independent claim 1. As discussed in detail above with regard to the Section 102 rejection of claim 1, the Examiner stated that “[the Rafter reference] teaches a cMUT embodiment associated with Fig. 6 and col. 13-14 top lines where the curved partially cylindrical lens 210 depicted in Fig. 2 in association with the single piezocrystal multi-element diced design may be assumed to be also used with the MUT variant which is stated to be interchangeable therewith.” Office Action, page 3. However, the Rafter reference merely states that “the response characteristics associated heretofore with a multi-element single crystal transducer may be accomplished with a MUT” and that FIG. 6 illustrates a MUT in accordance with the invention. Rafter, col. 13, lines 28-32. The Rafter reference never teaches or suggests that the MUT described in columns 13-14 may be coupled to a curved lens in the same way as the single crystal element slivers illustrated in FIG. 2 of the Rafter reference. Indeed, the MUT embodiment is an entirely separate embodiment of the Rafter reference. Suggesting that multi-element single crystal transducers may have similar response characteristics to MUTs does not necessarily suggest that similar

coupling to a curved lens is possible. Furthermore, the Brief Description of the Drawings section notes that FIG. 6 “is a simplified cross-sectional view illustrating a micro-machined ultrasonic transducer (MUT) that can be integrated with the ultrasonic imaging system of FIG. 1.” (Emphasis added). It does not suggest that FIG. 6 can be integrated into FIG. 2, which shows the coupling with a curved lens. For comparison, the Brief Description of the Drawings section notes that FIG. 2 “is a perspective drawing of an ultrasonic transducer having single crystal element slivers and multiple matching layers that can be integrated with the ultrasonic imaging system of FIG. 1.” (Emphasis added). Therefore, FIGS. 2 and 6 are alternative embodiments that both represent transducers 102 as depicted in FIG. 1 of the Rafter reference. Hence, the Rafter reference does not teach or suggest “an array of MUT cells and a curved lens coupled to the array of MUT cells” since the curved lens is a part of the embodiment illustrated in FIG. 2 and the MUT cells are a part of an alternative embodiment illustrated in FIG. 6.

The secondary references do not obviate the deficiencies of the Rafter reference. The Examiner alternatively stated that “Dreschel et al similarly teaches that a lens may be attached to a cMUT array per col. 9-10 discussion considered together with col. 8 lines 62-65, albeit that the lens is not explicitly stated to be curved.” In fact, the Dreschel reference only mentions lenses one time in an extremely cursory manner:

Device 7 may also, as desired, be joined or abutted to other useful acoustic components (not shown) such as matching layers, attenuative backers, isolation windows or acoustic lenses.

Dreschel, col. 8, lines 62-65. In addition, similar to the discussion above with respect to the Rafter reference, the Dreschel reference merely describes a “next major preferred embodiment” when discussing MUTs in columns 9-10. *Id.* at col. 9, lines 56-57. Dreschel does not teach or suggest “joining or abutting” with acoustic lenses as described with respect to the “second major embodiment” illustrated in FIG. 3. *Id.* at col. 7, lines 59-60. Moreover, based on the sparse description in the specification, the Dreschel

reference does not enable one of ordinary skill in the art to couple a curved lens to an array of MUT cells. The remaining references also fail to obviate the deficiencies of the Rafter and Dreschel references.

For at least these reasons, among others, Appellants stress that the cited references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 1 and its dependent claims.

Features of independent claim 45 and dependent claim 42 omitted from the cited references

Independent claim 45 and dependent claim 42 recite, in generally similar language, a curved lens “coupled in at least close proximity or directly to membranes of the MUT cells.” It should be noted that dependent claim 42 depends from independent claim 1, as discussed above.

The cited references, taken alone or in hypothetical combination, fail to teach or suggest a curved lens “coupled in at least close proximity or directly to membranes of the MUT cells.” In contrast, the Rafter reference discloses single crystal element slivers 214 and an acoustic lens 210 with multiple matching layers 212 interposed between them. *See, e.g.*, Rafter, col. 10, lines 29-39; FIG. 2. As discussed above with respect to independent claim 1, FIG. 2 of the Rafter reference illustrates an entirely separate embodiment from the MUT embodiment illustrated in FIG. 6. Furthermore, it is clear that the matching layers 212 interposed between the single crystal element slivers 214 and the acoustic lens 210 preclude the acoustic lens 210 from being “coupled in at least close proximity or directly to membranes” of the single crystal element slivers 214. Moreover, the Dreschel reference fails to obviate the deficiencies of the Rafter reference. Instead, the Dreschel reference merely discloses a device 7 that may be joined or abutted to, among other things, acoustic lenses. There is absolutely no discussion in the Dreschel reference of the acoustic lenses being coupled to membranes of MUT cells. The

remaining references also fail to obviate the deficiencies of the Rafter and Dreschel references.

For at least these reasons, among others, Appellants stress that the cited references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 45 and its dependent claims or dependent claim 42.

Accordingly, Appellants respectfully request withdrawal of the foregoing rejections under 35 U.S.C. § 103.

Improper Combination - Lack of Objective Evidence of Reasons to Modify/Combine

In addition, the Examiner has not shown objective evidence of the requisite motivation or suggestion to modify or combine the cited references to reach the present claims. As summarized above, the *KSR* court did not diminish the requirement for objective evidence of obviousness. *KSR*, *slip op.* at 14 (“To facilitate review, this analysis should be made explicit. See *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”); see also, *In re Lee*, 61 U.S.P.Q.2d 1430, 1436 (Fed. Cir. 2002) (holding that the factual inquiry whether to combine references must be thorough and searching, and that it must be based on *objective evidence of record*). In the present Office Action, the Examiner combined the cited references based on *conclusory and subjective statements* with regard to the various rejections. Accordingly, in view of the lack of any *objective evidence* of the requisite motivation or suggestion to combine the cited references, Appellants submit that the Examiner has not made a *prima facie* case of obviousness of the present claims.

C. **Third Ground of Rejection**

The Examiner rejected claims 3, 4, 9, and 46 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel further in view of Ishrak. Claims 3, 4, and 9 depend from independent claim 1. Claim 46 depends from independent claim 45. As discussed in detail above with reference to the Second Ground of Rejection, Rafter and Dreschel cannot support a *prima facie* case of obviousness of independent claims 1 and 45. Furthermore, Ishrak cannot obviate these deficiencies of Rafter and Dreschel. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claims.

D. **Fourth Ground of Rejection**

The Examiner rejected claims 6 and 7 under 35 U.S.C. § 103(a) as unpatentable over Rafter alone or in view of Dreschel further in view of Fraser. Claims 6 and 7 depend from independent claim 1. As discussed in detail above with reference to the Second Ground of Rejection, Rafter and Dreschel cannot support a *prima facie* case of obviousness of independent claim 1. Furthermore, Fraser cannot obviate these deficiencies of Rafter and Dreschel. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claims.

E. **Fifth Ground of Rejection**

The Examiner rejected claims 11 and 12 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel further in view of Hanafy. Claims 11 and 12 depend from independent claim 1. As discussed in detail above with reference to the Second Ground of Rejection, Rafter and Dreschel cannot support a *prima facie* case of obviousness of independent claim 1. Furthermore, Hanafy cannot obviate these deficiencies of Rafter and Dreschel. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claims.

F. **Sixth Ground of Rejection**

The Examiner rejected claims 13 and 14 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel further in view of Ishrak further in view of Eaton. Claims 13 and 14 depend from independent claim 1. As discussed in detail above with reference to the Second Ground of Rejection, Rafter and Dreschel cannot support a *prima facie* case of obviousness of independent claim 1. Furthermore, Ishrak and Eaton cannot obviate these deficiencies of Rafter and Dreschel. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claims.

In addition, Appellants stress that the Examiner's rejection appears to be improper, as it uses hindsight reconstruction to pick and choose elements from four different prior art references. As noted above, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, "fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)). For this additional reason, Appellants stress that the Examiner has not made a *prima facie* case of obviousness of the present claims.

G. **Seventh Ground of Rejection**

The Examiner rejected claim 15 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel further in view of Ishrak further in view of Snow. Claim 15

depends from independent claim 1. As discussed in detail above with reference to the Second Ground of Rejection, Rafter and Dreschel cannot support a *prima facie* case of obviousness of independent claim 1. Furthermore, Ishrak and Snow cannot obviate these deficiencies of Rafter and Dreschel. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claim.

In addition, Appellants stress that the Examiner's rejection appears to be improper, as it uses hindsight reconstruction to pick and choose elements from four different prior art references. As noted above, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, "fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)). For this additional reason, Appellants stress that the Examiner has not made a *prima facie* case of obviousness of the present claim.

H. Eight Ground of Rejection

The Examiner rejected claim 17 under 35 U.S.C. § 103(a) as unpatentable over Rafter in view of Dreschel further in view of Robinson. Claim 17 depends from independent claim 1. As discussed in detail above with reference to the Second Ground of Rejection, Rafter and Dreschel cannot support a *prima facie* case of obviousness of independent claim 1. Furthermore, Robinson cannot obviate these deficiencies of Rafter

and Dreschel. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claim.

I. **Ninth Ground of Rejection**

The Examiner rejected claim 18 under 35 U.S.C. § 103(a) as unpatentable over Friemel in view of Barnes. As discussed above, Appellants previously submitted a Rule 131 Declaration to swear behind both Friemel and Barnes. Thus, the present rejection must be withdrawn.

J. **Tenth Ground of Rejection**

The Examiner rejected claims 39, 40, and 44 under 35 U.S.C. § 103(a) as unpatentable over Rafter alone or in view of Dreschel, in either case further in view of Fraser and Chiao or Mason. The Examiner also mentioned Barnes and Friemel in the body of this rejection. As discussed above, Appellants previously submitted a Rule 131 Declaration to swear behind both Friemel and Barnes. Thus, the present rejection must be withdrawn to the extent it relies upon Friemel and/or Barnes.

Features of independent claim 39 omitted from the cited references

Independent claim 39 recites, “a curved lens; a first multiplicity of MUT cells hard-wired together and disposed underneath the curved lens; a second multiplicity of MUT cells hard-wired together and disposed underneath the curved lens; CMOS electronics disposed underneath the first and second multiplicities of MUT cells; and a silicon substrate disposed underneath the CMOS electronics.”

The cited references fail to teach or suggest, *inter alia*, “a curved lens; a first multiplicity of MUT cells hard-wired together and disposed underneath the curved lens; a second multiplicity of MUT cells hard-wired together and disposed underneath the curved lens,” as recited by claim 39. The Rafter reference never teaches or suggests that the MUT described in columns 13-14 may be coupled to a curved lens in the same way as the

single crystal element slivers illustrated in FIG. 2 of the Rafter reference. Indeed, the MUT embodiment is an entirely separate embodiment of the Rafter reference. Furthermore, the Brief Description of the Drawings section notes that FIG. 6 “is a simplified cross-sectional view illustrating a micro-machined ultrasonic transducer (MUT) that can be integrated with the ultrasonic imaging system of FIG. 1.” (Emphasis added). It does not suggest that FIG. 6 can be integrated into FIG. 2, which shows the coupling with a curved lens. For comparison, the Brief Description of the Drawings section notes that FIG. 2 “is a perspective drawing of an ultrasonic transducer having single crystal element slivers and multiple matching layers that can be integrated with the ultrasonic imaging system of FIG. 1.” (Emphasis added). Therefore, FIGS. 2 and 6 are alternative embodiments that both represent transducers 102 as depicted in FIG. 1 of the Rafter reference. Hence, the Rafter reference does not teach or suggest “MUT cells hard-wired together and disposed underneath the curved lens” since the curved lens is a part of the embodiment illustrated in FIG. 2 and the MUT cells are a part of an alternative embodiment illustrated in FIG. 6.

The secondary references do not obviate the deficiencies of the Rafter reference. The Dreschel reference only mentions lenses one time in an extremely cursory manner:

Device 7 may also, as desired, be joined or abutted to other useful acoustic components (not shown) such as matching layers, attenuative backers, isolation windows or acoustic lenses.

Dreschel, col. 8, lines 62-65. In addition, similar to the discussion above with respect to the Rafter reference, the Dreschel reference merely describes a “next major preferred embodiment” when discussing MUTs in columns 9-10. *Id.* at col. 9, lines 56-57. Dreschel does not teach or suggest “joining or abutting” with acoustic lenses as described with respect to the “second major embodiment” illustrated in FIG. 3. *Id.* at col. 7, lines 59-60. Moreover, based on the sparse description in the specification, the Dreschel reference does not enable one of ordinary skill in the art to couple a curved lens to an

array of MUT cells. The remaining references also fail to obviate the deficiencies of the Rafter and Dreschel references.

For at least these reasons, among others, Appellants stress that the cited references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 39 and its dependent claims.

In addition, Appellants stress that the Examiner's rejection appears to be improper, as it uses hindsight reconstruction to pick and choose elements from five different prior art references. As noted above, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, "fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)). For this additional reason, Appellants stress that the Examiner has not made a *prima facie* case of obviousness of the present claims.

K. **Eleventh Ground of Rejection**

The Examiner rejected claim 41 under 35 U.S.C. § 103(a) as unpatentable over Rafter alone or in view of Dreschel, in either case further in view of Fraser and Chiao or Mason, further in view of Robinson. Claim 41 depends from independent claim 39. As discussed in detail above with reference to the Tenth Ground of Rejection, Rafter and/or

Dreschel in view of Fraser and Chiao or Mason cannot support a *prima facie* case of obviousness of independent claim 39. Furthermore, Robinson cannot obviate these deficiencies of Rafter, Dreschel, Fraser, Chiao, and Mason. As a result, the Examiner has not made a *prima facie* case of obviousness of the present claims.

In addition, Appellants stress that the Examiner's rejection appears to be improper, as it uses hindsight reconstruction to pick and choose elements from six different prior art references. As noted above, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, "fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)). For this additional reason, Appellants stress that the Examiner has not made a *prima facie* case of obviousness of the present claims.

Conclusion

Appellants respectfully submit that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: September 11, 2008

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8. **APPENDIX OF CLAIMS ON APPEAL**

1. An ultrasonic probe comprising an array of MUT cells and a curved lens coupled to the array of MUT cells.

2. The probe as recited in claim 1, wherein the curved lens is adhered to the array of MUT cells, and a planar substrate, the MUT cells being built on the substrate.

3. The probe as recited in claim 2, further comprising a layer of adhesive material between the curved lens and the array.

4. The probe as recited in claim 3, further comprising a barrier layer disposed between the layer of adhesive material and the array of MUT cells, the barrier layer being made of a material that prevents chemical diffusion from the curved lens to the MUT cells.

6. The probe as recited in claim 1, wherein the array comprises a first multiplicity of MUT cells hard-wired together and a second multiplicity of MUT cells hard-wired together.

7. The probe as recited in claim 6, wherein the MUT cells of the first multiplicity are arranged side by side and cover a generally rectangular area, the length of the rectangle being aligned with an elevation direction, the curved lens being curved in the elevation direction.

8. The probe as recited in claim 2, wherein the lens is cylindrical, multifocal or elliptical.

9. The probe as recited in claim 2, further comprising adhesion promoting material applied on a front face of the array, a rear face of the curved lens, or both.

11. The probe as recited in claim 2, wherein the curved lens is made of a polymeric material.

12. The probe as recited in claim 11, wherein the curved lens is made of silicone rubber and the adhesive material is made of room-temperature vulcanizing silicone rubber.

13. The probe as recited in claim 9, wherein the adhesion-promoting material is a silicate.

14. The probe as recited in claim 9, wherein the adhesion-promoting material is an organometallic.

15. The probe as recited in claim 9, wherein the adhesion-promoting material is a reactive organosilane.

16. The probe as recited in claim 1, wherein each of the MUT cells is a capacitive MUT cell.

17. The probe as recited in claim 1, wherein each of the MUT cells is a piezoelectric MUT cell.

18. The probe as recited in claim 1, comprising:
a layer of CMOS electronics below the array of MUT cells; and
a silicon substrate below the layer of CMOS electronics.

39. An integrated device comprising:

a curved lens;

a first multiplicity of MUT cells hard-wired together and disposed underneath the curved lens;

a second multiplicity of MUT cells hard-wired together and disposed underneath the curved lens;

CMOS electronics disposed underneath the first and second multiplicities of MUT cells; and

a silicon substrate disposed underneath the CMOS electronics.

40. The device as recited in claim 39, wherein each of the MUT cells is a capacitive MUT cell.

41. The device as recited in claim 39, wherein each of the MUT cells is a piezoelectric MUT cell.

42. The probe as recited in claim 1, wherein the curved lens is coupled to the array of MUT cells in at least close proximity or direct contact with membranes of the MUT cells.

44. The device as recited in claim 39, wherein the curved lens is coupled to the first and second multiplicities of MUT cells in at least close proximity or direct adhesion with membranes of the MUT cells.

45. An ultrasonic probe, comprising:

a plurality of micromachined ultrasonic transducer cells;

a curved lens coupled in at least close proximity or directly to membranes of the plurality of micromachined ultrasonic transducer cells.

46. The ultrasonic probe as recited in claim 45, comprising one or more generally thin layers of adhesive and protective materials disposed between the curved lens and the membranes of the plurality of micromachined ultrasonic transducer cells.

9. **EVIDENCE APPENDIX**

None.

10. **RELATED PROCEEDINGS APPENDIX**

None.